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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to a Shovelling Machine

We, KARL SCHAEFF (Senior), ANNA SCHAEFF, HANS SCHAEFF and KARL SCHAEFF (Junior, all of Seestrasse 172, Langenburg, Wuerttemberg, Germany, and FRIEDRICH SCHAEFF, of Bahnhofstrasse 15, Rothenburg, o.d., Tauber, Germany, and RUDOLF SCHAEFF, of Hohe Warke 36, Essen, Germany, all of German nationality and trading jointly as Karl Schaeff K. G. Maschinenfabrik, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to a shovelling machine of the kind comprising a vehicle provided with a scoop which normally rests upon the ground in front of the vehicle, so that a load of soil or the like will be excavated and received by the scoop on forward movement of the vehicle. The scoop is attached to the vehicle by lifting means extending from either side of the vehicle and adapted to lift the scoop with its load. Means are also provided to tip the scoop at the desired height so as to eject its load for example into a waiting lorry. According to the present invention the lifting means are adapted to raise the scoop and discharge its load at a desired height in front of the vehicle, or optionally to swing the scoop over the vehicle from front to rear and discharge its load rearwardly of the vehicle.

In such a machine the provision of the pivotal axis of the lifting means high above and between front and rear axles on which wheels are mounted has the advantage, by comparison with the provision of the pivotal axis low down in the vinicity of the rear axle, that it is possible to load the scoop frontally at a considerably greater height and in discharging, to shoot the material rearwardly to a greater distance. There is, however, a difficulty in that the angle of swing

[*Price* 4s. 6d.]

We, KARL SCHAEFF (Senior), ANNA position and the rearward discharge position of the scoop amounts to almost 180°, and the lifting means swings out very far beyond the vertical position to the rearward discharge position.

In a known form of construction, an enforced movement into the rearward discharge position is obtained in that, when the vertical position of the lifting means is exceeded, a hydraulically actuated driving means which urges the lifting means from below is swung beyond a dead point and, the direction of movement of a piston of the hydraulically actuated driving means being then reversed, the piston takes up the load moment of the lifting means which begins to turn in the opposite direction when the vertical position is exceeded. This form of construction has the disadvantage that difficulties occur when the vehicle is steeply inclined, forwards or backwards.

In a machine according to the invention, the power imparted to each lifting arm of the lifting means acts approximately horizontally upon a guide lever mounted at an interval behind the pivotal axis of the swing loading member and adapted to pivot upon a fixed axis in the vehicle, the guide lever being downwardly directed, its free end being connected with the lifting arm by means of a link. The necessity for the line of effect of the lifting force to pass beyond a dead point is thus avoided, for the pivotal angle of the guide lever acted upon by the lifting force amounts to only a fraction of the pivotal angle of approximately 180° of the lifting arms. The swing of the lifting arms from the reception position when the scoop rests upon the ground in front of the vehicle to the rearward discharge position is therefore achieved without reversing the direction of the lifting force, so that control of the lifting force is very simple. Furthermore, the lifting force is most

effective in the region of swing of the lifting arms following immediately upon the reception position, and in that region the greater lifting force must be used. Since not only the guide lever but also the lifting arms are directly connected to the vehicle, a stable construction results.

In order to control the tipping motions of the scoop articulated to the ends of the lifting arms, additional hydraulically actuated driving means is mounted in known manner on each side of the vehicle, a piston of the said additional driving means engaging a bar approximately at the centre thereof which bar is articulated at one of its ends to the lifting arm of a point intermediate the ends thereof. The bar is upwardly directed in the reception position, and its free end is connected with the scoop by means of a thrust rod. This arrangement for the control of the tipping motion of the scoop has proved particularly effective in discharging the load forwardly of the vehicle. By means of this arrangement the rearward swing of the scoop from the reception position is limited by the rear end of the travel of the driving pistons. In order also to make possible a discharge of the scoop when the lifting means are swung rearwardly for which purpose the scoop must be swung in the direction opposite to that for frontal discharge, the tipping back of the scoop from the reception position is limited according to the invention before the rear end of travel of the driving pistons by stops on the bars which act against the lifting arms, the driving means being articulated to the vehicle at some distance behind the pivotal axis of the swing loading member, and valves being incorporated in the supply pipes supplying pressure agent to the driving means which valves act to block the pistons in their cylinders when the scoop is raised. Because the pivotal axis of the additional driving means for the tipping movement of the scoop is at an interval behind the pivotal axis of the lifting arms, and because of the possibility of blocking the pistons in their cylinders while the scoop is raised, the scoop, while the lifting means raise it, is moved progressively from the stop position in such manner that, in all positions of the lifting means, it maintains position ensuring there shall be no discharge of the load. In the rearward discharge position the stopped position of the scoop is such that the driving pistons can be moved up to their rear end of travel to empty it. To limit the tipping motion of the scoop in frontal discharge, a second stop can be provided, which can become effective in all operational positions within the forward travel of the driving pistons. It is thus possible to empty the loading scoop completely even at a slight height, and this is not possible with known frontal loaders. Furthermore, this second stop can prevent any undesired overtipping of the scoop when the lifting arms are in a vertical position.

According to the invention there is provided a shovelling mechine comprising a vehicle having front andl rear axles and lifting means comprising lifting arms each pivotally attached to a fixed bearing member on each side of the vehicle and having a pivotal axis above and approximately centrally between the front and rear axles, a scoop pivotally mounted between the lifting arms in such manner that the scoop may rest on the ground in front of the vehicle or may be swung by the lifting arms over the vehicle through an angle of approximately 180°, there being on each side of the vehicle a downwardly directed guide lever pivotally connected at one end behind the pivoted axis to a bearing member on the side of the vehicle, the other and lower end of the guide lever being pivotally connected to one end of a link the other end of which is pivotally connected to a lifting arm at a point intermediate the ends thereof, there being provided horizontal driving means pivotally connected at one end to the vehicle and at the other end to the guide lever near the point at which the guide lever is connected to the link.

The invention is hereinafter described with reference to an example diagrammatically illustrated in the accompanying drawings, in which:—

Figures 1 to 4 show side elevations of the various operative positions of the scoop of a shovelling machine according to the invention;

in Figure 1 it is in the reception position;

in Figure 2 it is in a front discharge position;

in Figure 3 it is shown in the vertical position;

in Figure 4 it is in the rearward discharge position; and

Figure 5 shows, in the reception position, the means of connecting a lifting arm with its lifting drive, and the tipping drive for the scoop.

On the vehicle which in the embodiment illustrated by way of example, is a tractor constructed as an endless track vehicle, the lifting arms 3 are pivotally mounted upon pins 4 at the pivotal axis in supporting members 5 on either side of the vehicle disposed approximately centrally between front and rear wheel axles 1 and 2, and far above the plane passing through the wheel axles, approximately at the height of the driver's seat, the pins being mounted in a fixed bearing member 5 on the frame of the vehicle. The scoop 6 is articulated to the free ends of the lifting arms 3. As a result of this arrangement of the pivotal pins 4, the lifting arms 3, in the reception position (Figure 1), assumes a position in which they are extremely inclined for-

wards and downwards, so that the angle of swing to the rearward discharge position (Figure 4) amounts to approximately 180°.

Each of the two lifting arms 3 is provided with a hydraulic driving means comprising a cylinder 8 pivotally mounted at 7 in the vicinity of the rear end of the vehicle, and a piston rod 9 engaging horizontally, at 11, a guide lever 10. The guide lever 10, which is of approximately sickle-shaped construction, is downwardly directed and adapted to pivot at one end about a pin 12 mounted in the supporting member 5 on which the lifting arm 3 is mounted. The free end of the guide lever 10 is connected, by means of a link 14, with the lifting arm 3 at a considerable distance in front of its pivotal axis 4.

In order to swing up the lifting means, the piston rods 9 of the driving means 8 are thrust out. Thus the guide levers 10 swing out in a forward direction and transmit their pivotal motion through the links 14 to the lifting arms 3.

It may be seen from Figures 1 to 4 that the pivotal motion of the lifting arms between the reception position (Figure 1) and the rearward discharge position (Figure 4), which motion extends through approximately 180°, is achieved by a very small pivotal motion of the guide levers 10.

In the embodiment illustrated by way of example, the pivotal angle of the guide levers 10 amounts to approximately 90° and attains the pivotal position corresponding to the rearward position of the scoop without the line of effect of the lifting force to its pivotal axis 12 reaching a dead point. In all operative positions of the lifting arms 3, the links 14 essentially maintain their angular position in relation to the guide levers 10 and the lifting arms 3, so that favourable power-transmission ratios are obtained.

To carry out the tipping motion of the loading scoop 6, additional hydraulically actuated driving means is provided on each side of the vehicle, which means comprises a pivotable cylinder 15 mounted on the supporting member lever 5, and a piston within the cylinder connected with a piston rod 16 which extends from the cylinder 15 and engages, at 19, a bar 18 which pivots on the lifting arm 3 at 17, which bar is upwardly directed in the reception position (Figure 1), the piston rod engaging the bar approximately centrally of the length of the bar. The free end of the bar 18 engages the scoop 6 by means of a thrust rod 21. The pivotal axis 20 of the cylinder 15 is provided at a distance behind the pivotal axis 4 of the lifting arm 3, between the axis 4 and the pivotal axis 12 of the guide lever 10 in the bearing member 5. The bar 18 is provided with two stops 22 and 23 which limit the travel of the piston 16, and thus the tipping of the scoop, by bearing upon the lifting arm 3. The stops 22 and 23 could also be mounted at other positions in the tipping system, for example on the scoop.

In the reception position (Figure 1) with the scoop 6 resting upon the ground in front of the vehicle, the two stops 22 and 23 are raised from the lifting arm 3. Then, with the lifting arms 3, still lowered, the filled loading scoop is tipped back into the position shown in chain-dotted line, which position is determined by the stop 22 bearing on the lifting arm, (Figure 5). Then the loading scoop assumes a position in which none of the load can be shaken out when the lifting arms are subsequently swung up. During the whole of the following lifting motion, the piston 16 is blocked in the cylinder 15 due to the closing of valves in pipes through which hydraulic fluid enters and leaves the said cylinders, (which valves are not illustrated), so that the piston rod 16 is unable to perform any displacement movement in relation to the cylinder. Because of the displacement of the pivotal axes 4 and 20 of the lifting arm and of the cylinder 15, the loading scoop is nevertheless pivoted, and in such manner that during the whole lifting movement, either to a frontal discharge position (Figure 2) or to a rearward discharge position (Figure 4), the scoop constantly assumes a position in which it is ensured that the load will not tip out. During this movement, the stop 22 again moves away from the lifting arm 3. For frontal discharge the operation is reversed and the piston rod 16 is moved out of the cylinder 15 until, for example, the stop 23 becomes effective. Then the loading scoop is tipped down into the discharge position illustrated in chain-dotted line in Figure 2.

In the rearward discharge position (Figure 4), to discharge the loaded scoop the piston rod 16 is moved into the cylinder 15 to the end of its travel, whereby the loading scoop is tipped from the horizontal position illustrated into the tipped position illustrated in chain-dotted lines. The total travel of the piston rod 16 must be greater by the amount of this lifting movement than would be necessary for frontal unloading. In the other direction of travel the end travel of the piston rod 16 is extended so far that the stop 23 can become effective in all operational positions.

The stops 22 and 23 may be mounted at any other suitable alternative positions on the loading apparatus.

WHAT WE CLAIM IS:—

1. A shovelling machine comprising a vehicle having front and rear axles and lifting means comprising lifting arms each pivotally attached to a fixed bearing member on each side of the vehicle and having a pivotal axis above and approximately centrally between the front and rear axles, a scoop pivotally

mounted between the lifting arms in such manner that the scoop may rest on the ground in front of the vehicle or may be swung by the lifting arms over the vehicle through an angle of approximately 180°, there being on each side of the vehicle a downwardly directed guide lever pivotally connected at one end behind the pivotal axis to a bearing member on the side of the vehicle, the other and lower end of the guide lever being pivotally connected to one end of a link the other end of which is pivotally connected to a lifting arm at a point intermediate the ends thereof, there being provided horizontal driving means pivotally connected at one end to the vehicle and at the other end to the guide lever at a point intermediate the points at which the guide lever is connected to the bearing member and the link and nearer to the latter point.

2. A shovelling machine as claimed in Claim 1 wherein means are provided on either side of the vehicle to rotate the scoop about its pivotal connections with the lifting arms, and to maintain the scoop in desired angular relationship with the lifting arms, said means comprising a bar pivotally connected at one of its ends to the lifting arm at a point intermediate the ends thereof and pivotally connected at its other end to one end of a thrust rod the other end of which is pivotally connected to the scoop at a point spaced from the point of pivotal connection of the scoop and lifting arm, and second hydraulically actuated driving means having one end pivotally connected to the supporting lever at a point intermediate the ends thereof, and the other end pivotally connected to the bar at a point approximately central thereof, valves being incorporated in supply pipes supplying a pressure agent to the second driving means, which valves serve to block the pistons of the second driving means in their cylinders when the lifting means is swung over the vehicle by the first mentioned piston means, and a rear stop being provided on the bar on at least one side of the vehicle which, acting against the lifting arm associated with the bar, serves to limit the swing of the lifting means rearwardly of the vehicle.

3. A shovelling machine as claimed in Claim 2 wherein the lifting means on at least one side of the vehicle is provided with a front stop on the bar which acts against the associated lifting arm and serves to limit the swing of the lifting means forwardly of the vehicle.

4. A shovelling machine substantially as described herein with reference to the accompanying drawings.

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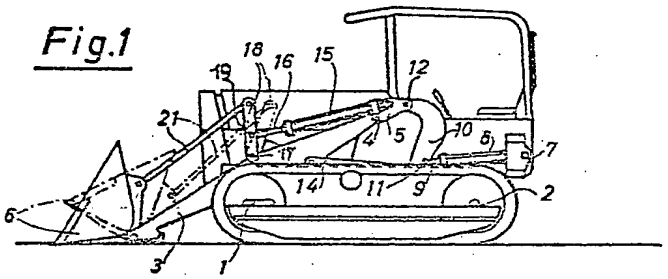
Fig.1



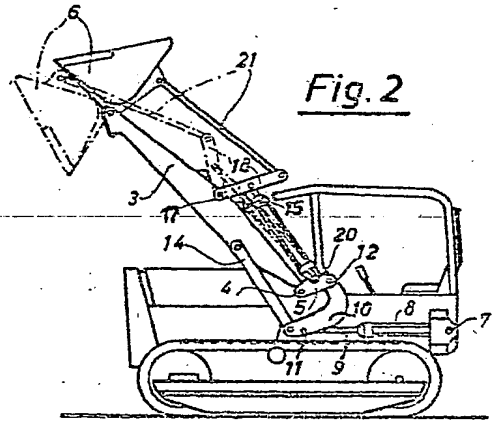


Fig. 2

888530 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

Fig. 3

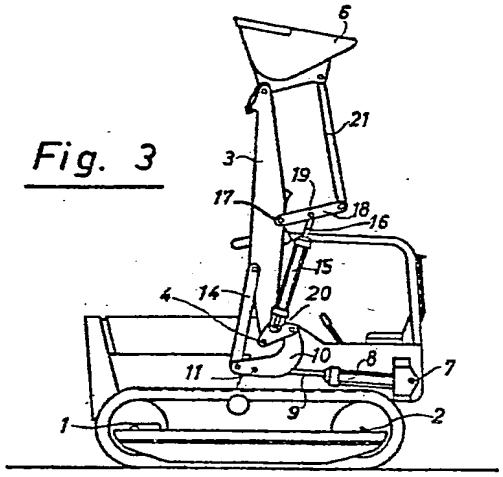


Fig. 4

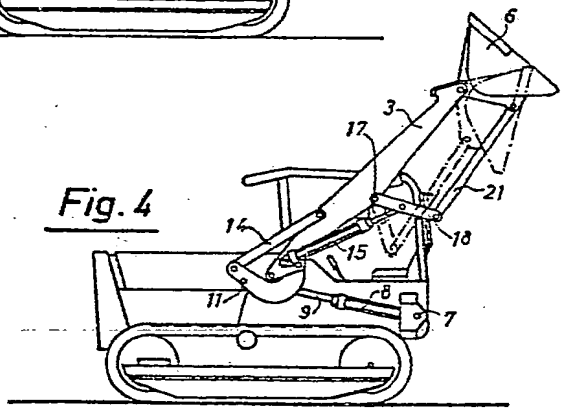
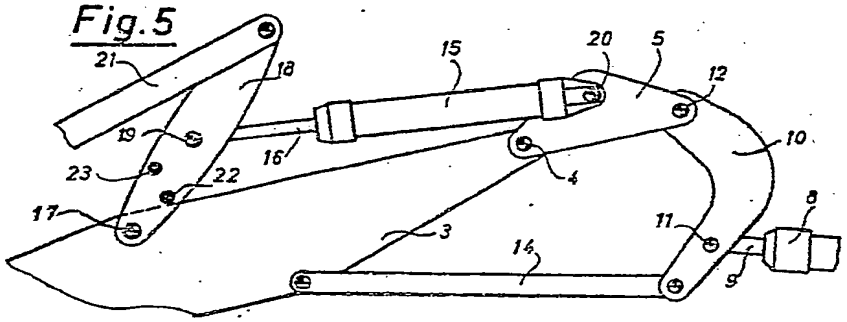


Fig. 5



888530 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

Fig.1

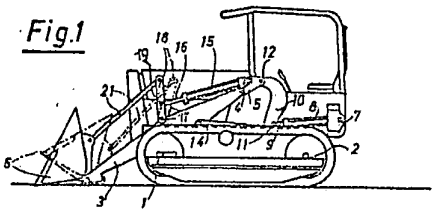


Fig. 3

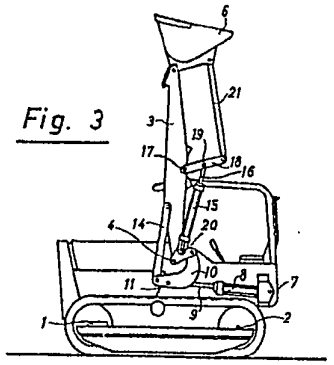


Fig.2

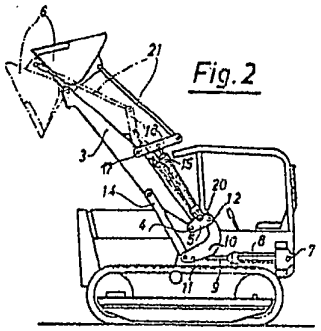


Fig.4

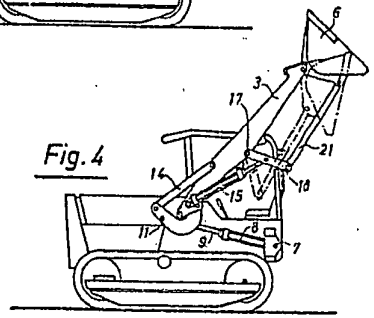


Fig.5